

# **SOUTH DAKOTA STATEWIDE FISHERIES SURVEY**

**2102-F-21-R-43**

**Name:** Lake Alvin

**County:** Lincoln

**Legal Description:** T100N- R49W-Sec. 33, 34

**Location from nearest town:** 3 miles east of Harrisburg, SD.

**Dates of present survey:** June 21-23, 2010 (netting)

**Dates of last survey:** June 23-25, 2009 (netting) June 1, 2009 (electrofishing)

<b>Managed Species</b>	<b>Other Species</b>
Largemouth Bass	Yellow Perch
Black Crappie	Black Bullhead
White Crappie	Common Carp
Bluegill	White Sucker
Channel Catfish	Green Sunfish
Fathead Minnow	Northern Pike
Walleye	

## **PHYSICAL DATA**

**Surface area:** 105 acres

**Watershed area:** 24,564 acres

**Maximum depth:** 26 feet

**Mean depth:** 9 feet

**Volume:** 930 acre feet

**Shoreline length:** 4.3 miles

**Contour map available:** Yes

**Date prepared:** 1997

**Lake elevation observed during the survey:** Full

**Beneficial use classification:** (4) warmwater permanent fish propagation, (7) immersion recreation, (8) limited-contact recreation and (9) fish and wildlife propagation and stock watering.

## **Introduction**

Lake Alvin is an artificial impoundment formed by the construction of a dam across the lower end of Nine Mile Creek. It was named for Alvin Dempewolf, the only World War 1 soldier from Harrisburg who died overseas. The construction of the dam was completed in August 1954 and the lake completely filled in 1957. The concrete spillway for the dam was replaced in 1994.

## **Ownership of Lake and Adjacent Lakeshore Properties**

Most of the land inundated by and surrounding Lake Alvin is owned and managed by the South Dakota Department of Game, Fish and Parks (GFP). The Parks Division of GFP manages a State Recreation Area surrounding the southeast, east, and northeast corners of the lake as well as a Lake Access Area on the northwest corner of the lake. The remainder of the shoreline is privately owned.

## **Fishing Access**

The Lake Alvin Recreation Area has a single lane boat ramp with a dock, public toilet, and parking lot as well as several areas accessible to shore fishing. On the southeast corner of the dam there is a handicapped accessible fishing dock and several shorefishing areas. The Lake Access Area on the northwest corner of the lake has a public toilet and a narrow boat ramp with a dock suitable for small boats. There is plenty of shoreline to fish; however, the water is shallow in this area. The entire lake has been designated as a no-wake zone to protect the shoreline from erosion. At no time can boats exceed 5 mph or produce a visible wake.

## **Field Observations of Water Quality and Aquatic Vegetation**

The Secchi depth measurement during the survey was 0.41 m (16 in) near the east boat ramp. The water was much more turbid in the west end. Small beds of sago pondweed (*Potamogeton pectinatus*) and floating leaf pondweed (*Potamogeton natans*) were scattered along the south shore. Sparse stands of common cattail (*Typha spp.*) are found at the west end of the lake. GFP finished a fencing project in 2009 that excluded cattle from the lake entirely.

### **Flood:**

On July 29, 2010, heavy rain in the Nine Mile Creek watershed caused Lake Alvin to flood and the water level peaked about 15 feet above the crest of the dam. The lake and all of the facilities were closed for several days for safety reasons.

After water levels had returned to normal, trap nets were set in early August to check for significant changes in fish abundance or species composition recorded during the late June survey. Trap net CPUE for bluegill, black crappie and channel catfish was similar to CPUE during the June survey. Bigmouth buffalo and river carpsucker were two new species that had never before been sampled and must have entered the lake during the flood. Largemouth bass from a SDSU study were still present when electrofishing was conducted in September. In another study, zooplankton and invertebrate populations appeared to more abundant following the flood, likely due to the sudden influx of nutrients.

## **BIOLOGICAL DATA**

### **Methods:**

Lake Alvin was sampled on June 21-23, 2010 with ten overnight trap-net sets. The trap nets are constructed with 19-mm-bar-mesh ( $\frac{3}{4}$  in) netting, 0.9 m high x 1.5 m wide (3 ft high x 5 ft wide) frames and 18.3 m (60 ft) long leads. Sampling locations are displayed in Figure 3.

### **Trap Net Catch**

Black crappie (66.0%), black bullhead (21.3%), and bluegill (7.7%) were the most common species sampled in the trap nets (Table 1). Four additional species were also sampled.

**Table 1.** Total catch from ten overnight trap nets set at Lake Alvin, Lincoln County, June 21-23, 2010.

Species	Number	Percent	CPUE	80% C.I.	Mean CPUE*	PSD	RSD-P	Mean Wr
<b>Black Crappie</b>	1,837	66.0	183.7	+77.8	34.8	1	0	110
<b>Black Bullhead</b>	594	21.3	59.4	+16.2	48.1	81	0	85
<b>Bluegill</b>	213	7.7	21.3	+15.5	96.3	61	4	94
<b>Channel Catfish</b>	84	3.0	8.4	+3.9	2.2	22	0	82
<b>White Sucker</b>	43	1.5	4.3	+1.7	5.1	100	98	86
<b>White Crappie</b>	8	0.3	0.8	+0.8	14.2	--	--	--
<b>Common Carp</b>	4	0.1	0.4	+0.4	0.1	--	--	--

\* 10 years (2000-2009)

**Table 2.** Catch per unit effort by length category for various fish species captured with trap nets in Lake Alvin June 21-23, 2010.

Species	Substock	Stock	S-Q	Q-P	P+	All sizes	80% C.I.
<b>Black Crappie</b>	-	183.7	181.8	1.9	-	183.7	+77.8
<b>Black Bullhead</b>	0.6	58.8	11.2	47.6	-	59.4	+16.2
<b>Bluegill</b>	-	21.3	8.3	12.1	0.9	21.3	+15.5
<b>Channel Catfish</b>	3.0	5.4	4.2	1.2	-	8.4	+3.9
<b>White Sucker</b>	-	4.3	-	0.1	4.2	4.3	+1.7
<b>White Crappie</b>	-	0.8	0.6	0.2	-	0.8	+0.8
<b>Common Carp</b>	-	0.4	-	0.3	0.1	0.4	+0.4

Length categories can be found in Appendix A.

## **Black and White Crappie**

**Management objective:** Maintain a crappie population with a trap-net CPUE between 15 and 25 and PSD of at least 40.

Black crappie trap-net CPUE in 2010 was 5 times the 10-year average (Table 3) and comprised entirely of a large 2008 year class (Table 4). Growth was between statewide and regional means (Table 4). However, growth of Lake Alvin crappies commonly decreases after age-3. The flood of 2010, with it's large influx of nutrients possibly fueling increased invertebrate and zooplankton populations, may temporarily increase crappie growth.

The crappie management objective was changed to reflect observations that larger crappies are produced in Lake Alvin only when crappie densities are lower.

**Table 3.** Stock length black crappie trap-net CPUE, PSD, RSD-P and mean Wr for Lake Alvin, Lincoln County, 2001-2010.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Mean*
CPUE	63.9	68.0	28.8	19.3	26.7	17.7	32.1	15.9	16.7	183.7	35.1
PSD	14	25	49	29	10	34	3	13	38	1	24
RSD-P	0	0	0	0	0	7	0	0	0	0	1
Mean Wr	106	112	93	90	94	102	102	102	110	110	102

\* 10 years (2000-2009)

**Table 4.** Average back-calculated lengths (mm) for each age class of black crappie in Lake Alvin, Lincoln County, 2010.

Year Class	Age	N	Back-calculation Age							
			1	2	3	4	5	6	7	8
2008	2	1,837	85	162						
<b>All Classes</b>			<b>85</b>	<b>162</b>						
Statewide Mean			83	147	195	229	249			
Region III Mean			95	167	219	253	274			
SLI* Mean			78	134	180	209	226			

\*Small Lakes and Impoundments (<150 acres)

The white crappie population was decimated by a fish kill in 2004 and has not yet recovered (Table 5).

**Table 5.** White crappie trap-net CPUE, PSD, RSD-P and mean relative weight (Wr) for Lake Alvin, Lincoln County, 2001-2010.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Mean*
CPUE	17.1	12.4	74.8	0.9	0.1	0.8	0.3	0.2	0.1	0.8	14.2
PSD	15	17	49	67	--	--	--	--	--	--	35
RSD-P	3	2	0	0	--	--	--	--	--	--	1
Mean Wr	83	108	88	78	--	--	--	--	--	--	91

\*10 years (2000-2009)

## **Bluegill**

**Management objective:** Maintain a bluegill population with a trap-net CPUE of at least 20 and RSD-18 of at least 20.

The bluegill population has met the management objective for two consecutive years with a substantial improvement in size structure (RSD-18) since 2008 (Table 6). Similar to the crappie population, it appears Lake Alvin will only produce larger bluegills when they are lower in abundance. The population size structure may have been improved by the removal of 1,267 fish in 2007.

Age-2 fish were most abundant, but fish up to age-6 were present in the catch (Table 7). Growth of abundant 2 year old fish is better than the statewide, small impoundment and regional means (Table 7). Condition (Wr) was below average this year.

**Table 6.** Bluegill trap-net CPUE, PSD, RSD-P and mean Wr for Lake Alvin, Lincoln County, 2001-2010.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Mean*
CPUE	48.3	111.8	229.3	172.1	186.1	47.5	87.9	26.1	27.5	21.3	96.3
PSD	26	11	26	47	60	51	37	88	84	61	46
RSD-18	1	0	1	5	0	5	3	8	62	19	9
RSD-P	0	0	0	0	0	0	0	0	3	4	0
Mean Wr	86	119	94	88	95	92	91	99	110	91	98

\*10 years (2000-2009)

**Table 7.** Average back-calculated lengths (mm) for each age class of bluegills in Lake Alvin, Lincoln County, 2010.

Year Class	Age	N	Back-calculation Age							
			1	2	3	4	5	6	7	8
2008	2	164	61	133						
2007	3	8	44	105	168					
2006	4	10	44	101	150	174				
2005	5	29	48	100	141	164	183			
2004	6	2	43	102	141	160	173	194		
<b>All Classes</b>		<b>213</b>	<b>48</b>	<b>108</b>	<b>150</b>	<b>166</b>	<b>178</b>	<b>194</b>		
Statewide Mean			55	103	141	166				
Region III Mean			60	116	157	180				
SLI* Mean			53	101	138	163				

\*Small Lakes and Impoundments (<150 acres)

## **All Fish Species**

Only seven species were sampled in 2010 (Table 8). Channel catfish and black crappie CPUE were the highest on record. CPUE for other species was within previously observed ranges.

**Table 8.** Trap-net (TN) CPUE for all fish species sampled in Lake Alvin, Lincoln County, 2001-2010.

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
GOS	0.1	--	--	--	0.1	--	0.1	--	--	--
COC	0.1	0.2	--	0.1	0.5	--	--	--	0.1	0.4
WHS	9.4	4.8	2.5	4.3	3.8	2.5	4.5	7.1	2.6	4.3
BLB	0.1	1.6	8.2	16.5	11.8	198.2	136.8	39.2	65.7	59.4
CCF	1.1	2.5	0.9	1.8	0.7	2.4	1.2	3.1	7.3	8.4
NOP	0.2	0.3	0.1	--	0.1	--	0.1	0.1	0.7	--
GSF	0.1	--	0.2	0.2	0.2	0.3	0.5	--	0.9	--
HYB	--	--	3.8	--	--	0.1	0.1	--	0.2	--
OSF	6.9	2.8	1.4	0.9	--	--	4.0	0.2	--	--
BLG	48.3	111.8	229.3	172.1	186.1	47.5	87.9	26.1	27.5	21.3
SMB	--	0.2	--	--	--	--	--	--	--	--
LMB	--	--	--	--	--	0.1	--	--	0.1	--
WHC	17.1	12.4	74.8	0.9	0.1	0.8	0.3	0.2	0.1	0.8
BLC	63.9	68.0	26.2	19.3	26.7	17.7	32.1	15.9	16.7	183.7
YEP	5.0	3.4	2.9	1.7	0.4	0.2	0.2	--	0.2	--
WAE	0.1	--	--	--	--	--	--	--	--	--
FRD	--	--	--	--	--	--	--	--	0.6	--

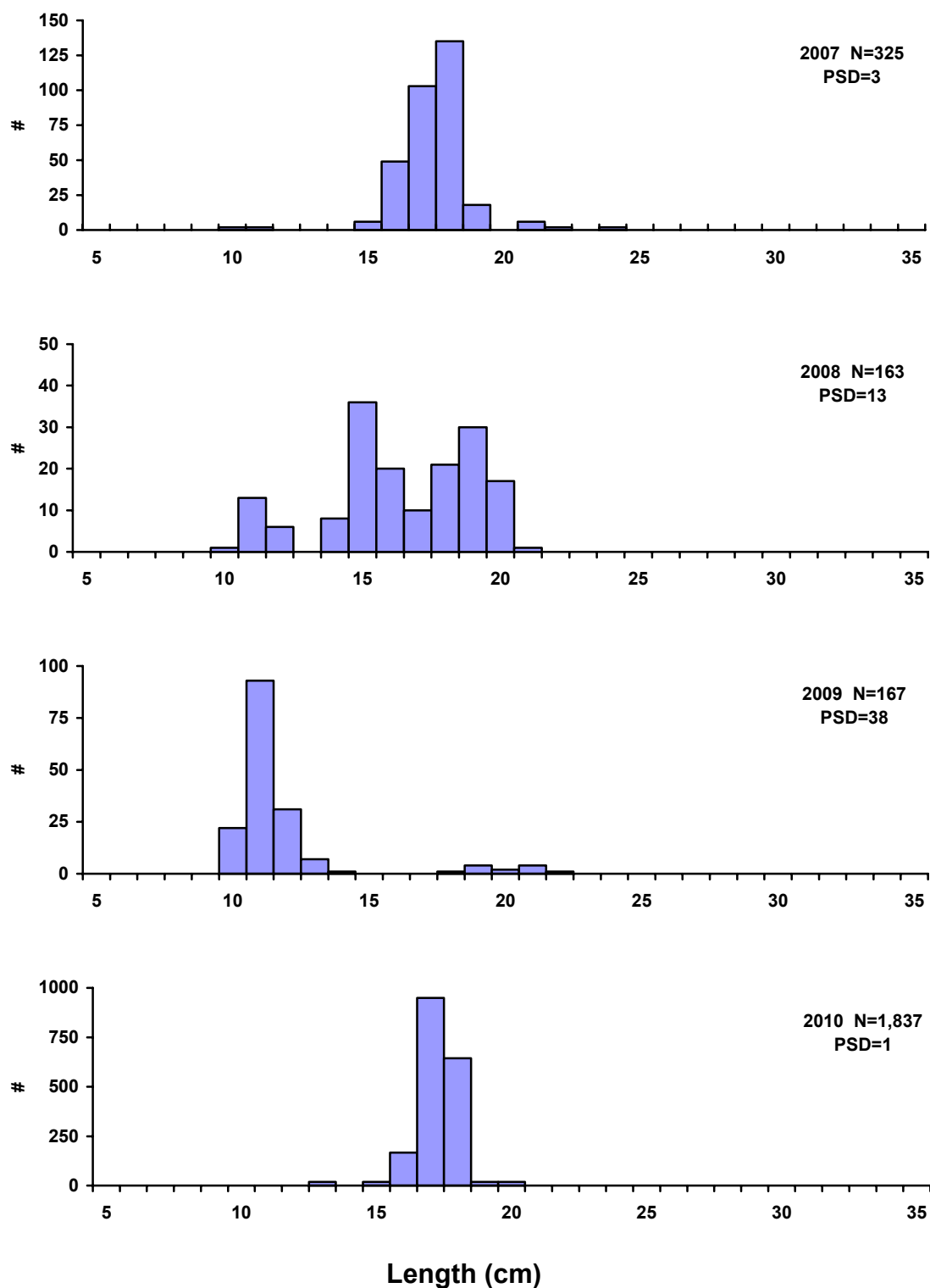
GOS (Golden Shiner), COC (Common Carp), WHS (White Sucker), BLB (Black Bullhead), CCF (Channel Catfish), NOP (Northern Pike), GSF (Green Sunfish), HYB (Hybrid Sunfish), OSF (Orange-spotted Sunfish), BLG (Bluegill), LMB (Largemouth Bass), SMB (Smallmouth Bass), WHC (White Crappie), BLC (Black Crappie), YEP (Yellow Perch), WAE (Walleye), FRD (Freshwater Drum)

## **MANAGEMENT RECOMMENDATIONS**

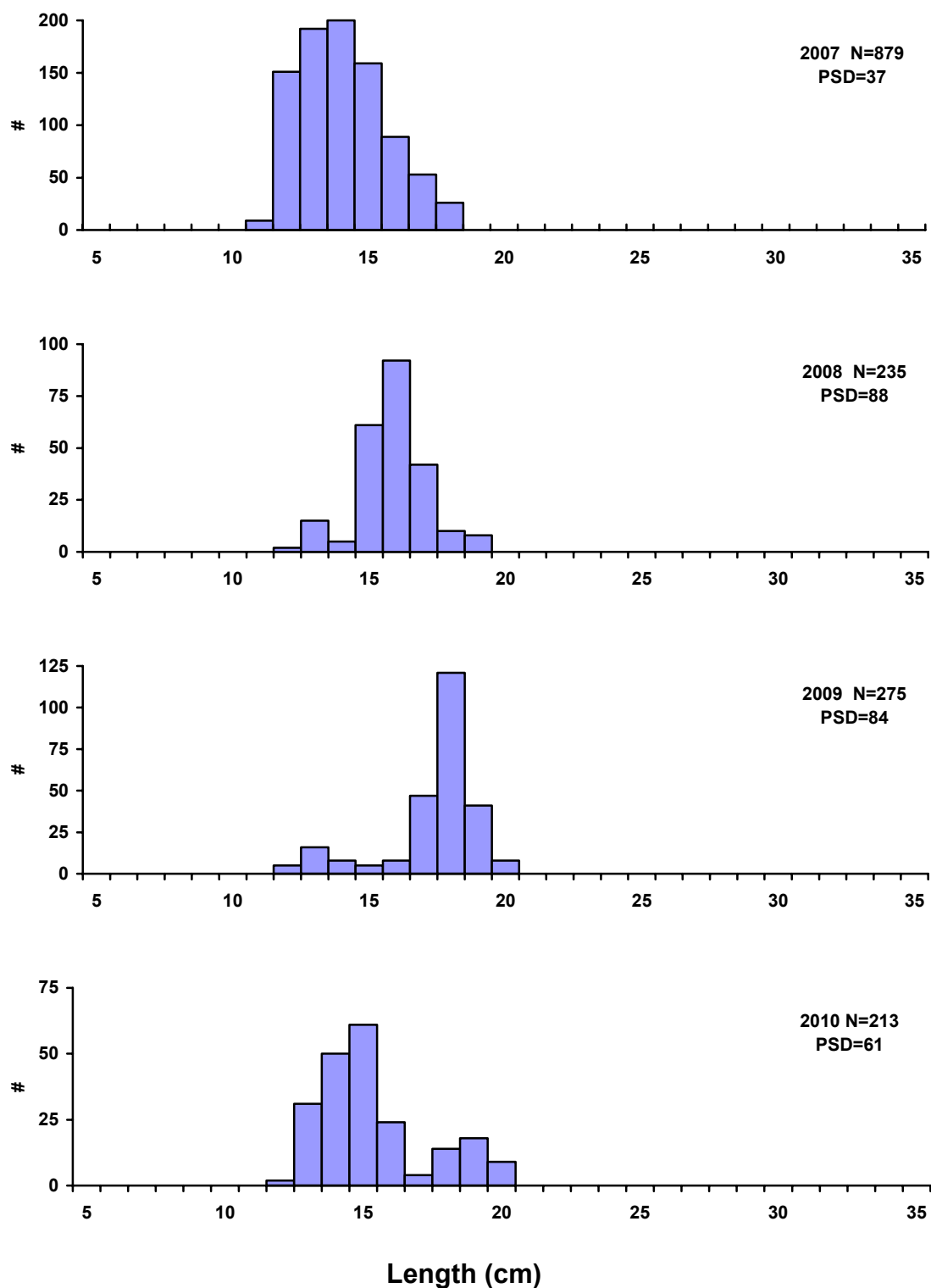
1. Funding has been approved to build a silt retention dam on Nine Mile Creek above Lake Alvin. This dam will prevent sediment and other pollutants from entering the lake resulting in better water quality and aquatic habitat. Construction is tentatively scheduled to begin in 2011.
2. A project to install a water level control structure is under consideration. The structure will allow occasional lowering of water levels to dry and compact loose sediment in the upper portion of the lake, to establish terrestrial and wetland vegetation for short-term habitat improvement and to allow nutrients trapped in the sediments to be released and used for increased fish production.
3. Suspend efforts to improve crappie and bluegill growth and population size structure through fish removals and supplemental forage stocking. These activities may affect our ability to successfully evaluate the effects of the silt retention dam and water level manipulation.
4. Continue to monitor water quality, aquatic vegetation, invertebrates, and the fish population prior to and after the construction of a silt retention dam in order to evaluate the effects of the dam on these parameters and the fishery.
5. Stock walleye when surplus fish are available to increase angler use and diversify fishing opportunity.

**Table 11.** Stocking record for Lake Alvin, Lincoln County, 1991-2010.

<b>Year</b>	<b>Number</b>	<b>Species</b>	<b>Size</b>
1991	525,000	Fathead Minnow	Adult
	3,000	Walleye	Lrg. Fingerling
1992	30,000	Black Crappie	Fingerling
	12,000	Channel Catfish	Fingerling
	3,212	Walleye	Lrg. Fingerling
	29,500	Yellow Perch	Fingerling
1993	3,355	Walleye	Lrg. Fingerling
1994	9,036	Black Crappie	Lrg. Fingerling
1996	1,203	Black Crappie	Adult
1997	9,000	Largemouth Bass	Fingerling
2002	195	Largemouth Bass	Adult
2003	201	Largemouth Bass	Adult
2004	358	Channel Catfish	Adult
	220	Largemouth Bass	Adult
2005	460	Channel Catfish	Adult
2007	430	Walleye	Adult
2008	684,610	Fathead Minnow	Adult

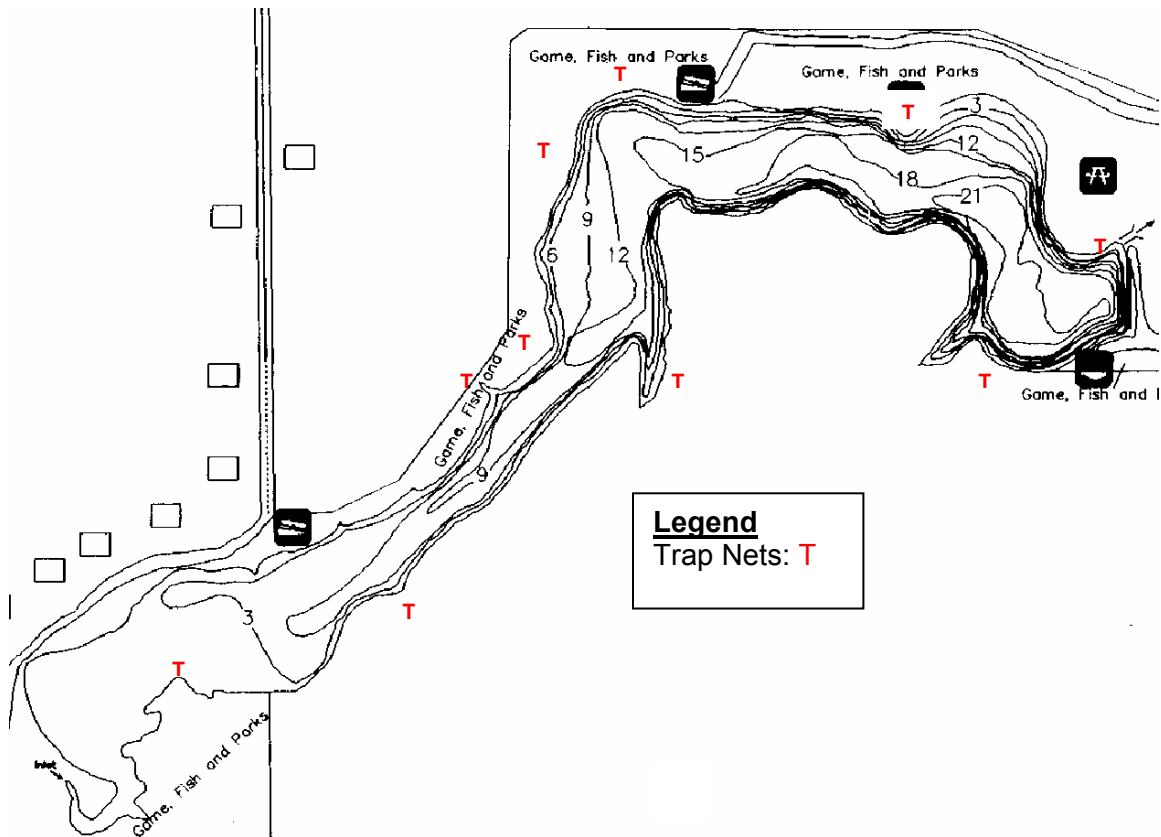


**Figure 1.** Length-frequency histograms for black crappies sampled with trap nets in Lake Alvin, Lincoln County, 2007-2010. Length frequency of the total catch was extrapolated from a sample of 100 measured fish.



**Length (cm)**

**Figure 2.** Length-frequency histograms for bluegill sampled with trap nets in Lake Alvin, Lincoln County, 2007-2010.



**Figure 3.** Sampling locations on Lake Alvin, Lincoln County, 2010.

**Appendix A.** A brief explanation of catch per unit effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr).

**Catch per Unit Effort (CPUE)** is the catch of animals in numbers or in weight taken by a defined period of effort. Can refer to trap-net nights of effort, gill net nights of effort, catch per hour of electrofishing, etc.

**Proportional Stock Density (PSD)** is calculated by the following formula:

$$\text{PSD} = \frac{\text{Number of fish} > \text{quality length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

**Relative Stock Density (RSD-P)** is calculated by the following formula:

$$\text{RSD-P} = \frac{\text{Number of fish} > \text{preferred length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

PSD and RSD-P are unitless and usually calculated to the nearest whole digit.

Size categories for selected species found in Region 3 lake surveys, in centimeters.

Species	Stock	Quality	Preferred	Memorable	Trophy
Walleye	25	38	51	63	76
Sauger	20	30	38	51	63
Yellow perch	13	20	25	30	38
Black crappie	13	20	25	30	38
White crappie	13	20	25	30	38
Bluegill	8	15	20	25	30
Largemouth bass	20	30	38	51	63
Smallmouth bass	18	28	35	43	51
Northern pike	35	53	71	86	112
Channel catfish	28	41	61	71	91
Black bullhead	15	23	30	38	46
Common carp	28	41	53	66	84
Bigmouth buffalo	28	41	53	66	84
Smallmouth buffalo	28	41	53	66	84

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For most fish, 30-60 or 40-70 are typical objective ranges for “balanced” populations. Values less than the objective range indicate a population dominated by small fish while values greater than the objective range indicate a population comprised mainly of large fish.

**Relative weight (Wr)** is a condition index that quantifies fish condition (i.e., how much does a fish weigh for its length). A Wr range of 90-100 is a typical objective for most fish species. When mean Wr values are well below 100 for a size group, problems may exist in food and feeding relationships. When mean Wr values are well above 100 for a size group, fish may not be making the best use of available prey.